Private Water Supplies

# Uranium – Guidance for Local Authorities

**Description and Background**

Uranium is a radioactive silver coloured metal. It is widespread in small quantities in nature, usually being associated with granite geology. The most common ore is uranite, formerly known as pitchblende, which is an oxide of uranium. It is often found with tin, copper and arsenic minerals. Canada, Australia and Kazakhstan are the largest producers of uranium[1]. Uranium's main use is as fuel in nuclear reactors.

A number of studies have found uranium in drinking water, mainly from private water supplies, at concentrations greater than 20µg/l, with concentrations up to 700 µg/l being detected at one source in Canada[2].

Many ores of uranium are largely insoluble in drinking water, although carbonate based minerals are soluble and these are likely to provide the most likely source of natural concentrations of uranium in drinking water.

**Affected areas**

Naturally Occurring
In the UK, BGS and SEPA have undertaken stream sediment studies[3] to determine the extent of trace contaminants. From these, high concentrations of uranium were found in stream water associated with the granitic bodies of the Grampians, Aberdeenshire, Dumfries and Galloway, Arran, Loch Etive, Rannoch, Helmsdale Doon and Criffel in Dumfries and Galloway. Highest concentrations (>2µg/l) occur in Strathmore, Caithness, the Black Isle, Rhynie and the Moray coast, Nairn and also the carboniferous area of Fife, the Central Belt, West and East Lothians.
It can be inferred that private water supplies in these areas may contain elevated uranium concentrations.

**Health Significance**

The primary concern with elevated concentrations of uranium in drinking water is its toxicity rather than any radiological effects. Uranium is known to have an acute effect on kidney function. Wider hazards associated with uranium in drinking water relate to its decay to radon, a significantly radioactive gas which presents a risk to health via inhalation. Good ventilation in areas where uranium is known to occur in drinking water is important.

The WHO does sets a provisional guideline value for uranium of 30µg/l, although it acknowledges that there is a lack of firm evidence on which to base a numerical standard. This value supersedes an earlier, lower, guideline value of 15µg/l. The USEPA sets an MCL standard of 30µg/l for uranium.

The EU currently does not set a standard for uranium in drinking water, although this may be under review.

**Risk Assessment and Monitoring**

The Private Water Supply Regulations do not require routine monitoring for uranium. However the Regulations require that the water does not contain any substance at a concentration or value which would constitute a potential danger to public health. If the monitoring local authority considers that uranium may be present if would be prudent to include it during audit monitoring.

Where uranium occurs naturally it is likely to be ubiquitous across the area and an alternative type of source should be sought. Point source contamination due to industry such as the combustion of coal products could be remediated or an alternative, less contaminated source sought.

**Options for resolving at source**

Although removal by coagulation and sedimentation methods may be possible, studies suggest it is highly pH dependent. It is also less likely to be practical for small water supplies. As uranium is only a risk when ingested (it cannot be inhaled or absorbed through the skin), point of use treatment at taps used for drinking may be a more effective control measure[4]. The risk from radon gas should also be considered in any supply where uranium is present in significant concentrations.

**Treatment**

Point of use treatment options for uranium consist mainly of reverse osmosis and anionic ion exchange[5]. The former may be simpler for domestic situations as minimal chemical consumables are required, although neither options are maintenance free. Adsorption onto GAC or other media may be effective where uranium concentrations are lower and could be considered for its simplicity, although removal rates are less certain than for the other methods.

**References / Further reading**

[1] World Nuclear Association 2012. *Uranium Mining Overview*. World Nuclear Association website: http://www.world-nuclear.org/info/nuclear-fuel-cycle/mining-of-uranium/uranium-mining-overview/

[2] WHO 2004. *Uranium in Drinking-water, Background document for development of WHO Guidelines for Drinking-water Quality*. WHO/SDE/WSH/03.04/118

[3] Macdonald, A M, Fordyce, Fm, Shand, P And Ó Dochartaigh, B É. 2005.
*Using geological and geochemical information to estimate the potential distribution of trace elements in Scottish groundwater*
BGS / SEPA Groundwater Programme Commissioned Report CR/05/238N

[4] Health Canada 2011. Water Talk – Uranium in Drinking Water. Health Canada ISBN: 978-1-100-17954-4.

[5] Air & Water Quality Maine. Uranium Treatment for the Private Homeowner. Air & Water Quality Maine Website: http://www.awqinc.com/uranium-treatment-for-the-private-homeowner/

**FAQ Fact Sheet for Owners and Users**

To be developed if necessary